

This M. of O. Sheet was prepared from Issue 19 of T-441139.

METHOD OF OPERATION
DISTRICT SELECTOR CIRCUIT

From special "A" operator, for use where zero operators trunk have a 34 ohm sleeve. Panel Machine Switching System.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used by zero and intercepting operators for the purpose of establishing connections for a subscriber who may be unable to dial or who may be entitled to A.B. toll service.

2. WORKING LIMITS

- 2.1 Maximum cord sleeve resistance - 128 ohms.
2.2 Maximum resistance for (L) relay over (FT) lead - 1220 ohms.

OPERATION

3. PRINCIPAL FUNCTIONS

The principal functions of this circuit are:

- 3.01 To select an idle sender.
3.02 To connect idle sender to operator's cord.
3.03 To maintain a visible busy signal at operator's positions.
3.04 To select an outgoing trunk to an incoming selector, manual office, "A" operator, desks or recording position under control of the sender.
3.05 To satisfy the sender for talking selection.
3.06 To dismiss the sender when selection beyond has been completed.
3.07 To cut through the operator's cord to the selected trunk.

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- 3.08 To restore to normal following disconnection by operator.
- 3.09 To pass back a signal to the operator when an "all paths busy" condition is encountered.
- 3.10 To restore to normal in case of "wipe out" by operator.
- 3.11 To restore associated incoming selector to normal on "wipe out".

4. CONNECTING CIRCUITS

- 4.1 Standard zero and intercepting operator's cord circuit equipped with a dial having a maximum sleeve resistance of 128 ohms.
- 4.2 Any standard subscriber's sender.
- 4.3 Any standard incoming selector.
- 4.4 Any standard R.C.I. trunk to a manual office.
- 4.5 Any standard trunk to "A" operator's or to desks.
- 4.6 Any standard outgoing recording trunk to long distance office.

DETAILED DESCRIPTION

5. INITIAL OPERATION - PLUG INSERTED

When the plug of the intercepting and zero operator's calling cord is inserted in a multiple jack of the district selector, the (SL) relay operates in the sleeve circuit and the (TRC) relay operates from battery through its inner winding, over the tip, through the cord circuit bridge, back over the ring, to ground on cam H. The (TRC) relay locks to ground at the (SL) relay operated, and operates the (L) relay through its outer winding. The (SL) relay operated, lights busy lamps at the operator's position. The (L) relay operated, advances the switch to position 2. As the switch enters position 1 3/4, battery at cam O is connected to the busy lamp circuit keeping the busy lamps lighted until the switch returns to normal.

6. SENDER SELECTION

6.1 SENDER IDLE

When the switch advances out of position 1, the (L) relay releases if the sender selector test brush (TST) is resting on the test terminal of an idle sender. The (L) relay released, makes the selected sender busy by connecting ground through the upper outer contact of cam H, break contact of the (L) relay, upper inner contact of cam L, lower outer contact of cam K over the (TST) lead to the associated sender circuit.

6.2 SENDER BUSY

If the sender selector test brush is on the terminal of a busy sender the (L) relay locks from battery through its inner winding and make contact to ground on the (TST) lead over the circuit traced above. With the (L) relay operated in position 2, the 200-B selector magnet energizes from battery, winding and break contact, lower contacts of cam C, make contact of the (L) relay, cam I, to ground at cam H. The selector brush will continue to hunt over the other terminals until an idle sender is found.

6.3 SENDER MADE BUSY

When an idle sender is found, the (L) relay releases, making the selected terminal busy. The release of the (L) relay removes the short circuit from the (CI) relay which operates from ground through lower, contacts of cam N, to battery through the break contact and winding of the 200-B selector magnet. Under this condition the 200-B selector does not receive sufficient current to operate. The (CI) relay operated, holds the sender busy from ground through its make contact over the (TST) lead, and closes the leads to the T, R and SC brushes.

6.4 CORD EXTENDED TO SENDER

With the switch in position 2, the tip and ring of the intercepting and zero operator's cord circuit is extended to the tip and ring of the sender through cams P and S and cam Q, thereby permitting a tone from the sender to be sent back to the operator as an indication that the connection is ready for dialing. The (L) relay released in position 2, advances the switch to position

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3 from ground on cam H, through the upper inner contact of cam I, break contact of the (L) relay, cam B, to battery through the R magnet. In position 3, 48 volt battery is connected to the (SC) lead for the purpose of operating the sender (SC) relay to advance the sender. This circuit is from battery. Cam U, 500 ohm resistance, cam J, (CI) relay operated to the (SC) lead. After the dialing period the fundamental circuit is closed for operating the (L) relay and the stepping relay in the sender circuit. This circuit is from ground through the stepping relay in the sender circuit, FT brush of the sender selector, operated (CI) relay, lower contacts, of cam L to battery through the inner winding of the (L) relay. The (L) relay operated in position 3 locks through its make contact and cam L to the same ground and advances the switch to position 4 from ground on cam H through the upper inner contact of cam I, make contact of the (L) relay, cam B, to battery through the R magnet.

7. BRUSH SELECTION

7.1 BRUSH SELECTED

With the switch in position 4, the (UP) magnet energizes from ground on cam H, upper inner contact of cam I make contact of the (L) relay, cam C, to battery through the (UP) magnet. The (UP) magnet operated causes the selector elevator to move upward for brush selection. As the selector moves upward in position 4, carrying the commutator brushes over the commutator segments, the (A) segment and brush intermittently connect ground to the tip side of the fundamental circuit, through cams K and L, holding the (L) relay operated through its inner winding but successively short-circuiting the stepping relay in the associated, sender circuit, thus releasing and permitting its reoperation, until the proper brush has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay, advancing the switch to position 5, as described for advancing the switch to position 3.

7.2 BRUSH TRIPPED

With the switch in position 5 and with the proper brush selected, the trip magnet (TM) operates from ground on cam N in order to trip the selected brush as the selector moves upward

for group selection. In position 5, the (L) relay again operates and locks over the fundamental circuit as described in position 3, advancing the switch to position 6.

8. GROUP SELECTION - GROUP SELECTED

With the switch in position 6, the (UP) magnet again operates as described under Brush Selection, carrying the selector elevator upward for group selection and tripping the selected brushes. As the selector moves upward for group selection, carrying the commutator brushes over the commutator segments, the B segment and brush intermittently connect ground to the tip side of the fundamental circuit, through cam L, holding the (L) relay operated through its inner winding but successively short-circuiting the stepping relay in the associated sender circuit, thus releasing and permitting its reoperation, until the proper group has been selected. When sufficient impulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay. The (L) relay released, advances the switch to position 7. With the switch in position 7, the (L) relay operates through cam I and advances the switch to position 8 from ground through the make contact of the (SL) relay, operated (TRC) relay, inner contacts of cam R, make contact of the (L) relay, cam B, to battery through the R magnet.

9. TRUNK HUNTING

9.1 FIRST TRUNK IDLE

In case the first trunk of a group is idle, the (L) relay releases when the switch advances out of position 7 1/4.

9.2 FIRST TRUNK BUSY

If the first trunk of the group is busy, ground on the S terminal of the busy trunk holds the (L) relay operated through cam E and inner winding of the relay. With the (L) relay held operated in position 8, the (UP) magnet is operated from ground on cam H, through the upper inner contact of cam I, make contact of the (L) relay, to battery through cam C and the UP magnet. The (UP) magnet operated, causes the selector elevator to hunt for an idle trunk. When an idle trunk is found, the circuit through the inner winding of the (L) relay is opened,

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but the relay does not release immediately on account of a circuit being closed from ground on the (C) commutator brush and segments through the outer contacts of cam R to battery through the outer winding of the (L) relay. When the brushes are centered on the trunk terminals, the circuit through the (C) commutator segment is opened and the (L) relay releases, in turn opening the circuit through the UP magnet which stops the selector the selector brushes on the terminals of the selected trunk. The (L) relay released, also advances the switch to position 9.

9.3 "C" COMMUTATOR

The adjustment of the (C) commutator brush with relation to the tripped sleeve multiple brush, is such that it does not break contact with the (C) commutator segment until slightly after the holding circuit through the inner winding of the (L) relay is opened, by the sleeve brush leaving the busy terminal and making contact with the sleeve terminal of the idle trunk. The (UP) magnet, therefore, remains operated and the selector continues to travel upward until the brushes are carried slightly above the center of the trunk terminals, allowing the locking pawl to enter the notch on the rack attached to the brush support rod. At this time the holding circuit through the outer winding of the (L) relay is opened at the (C) commutator, releasing the relay. The (L) relay released, disconnects ground from the commutator feed bar (G), and releases the (UP) magnet. The selector then drops into place, thus centering the brushes on the trunk terminals. During trunk hunting, in position 8 only the commutator feed ground is supplied through cam C, from ground on the armature of and under control of the (L) relay. This is to prevent the reoperation of the (L) relay by the closing of a circuit between the (C) commutator brush and segment, on the overthrow of the selector, or as it drops into place.

9.4 SELECTED TRUNK MADE BUSY

When an idle trunk has been found and the (L) relay released, temporary ground is immediately connected to the (S) terminal of the trunk, through the upper outer contact of cam H, break contact of the (L) relay, lower outer and upper inner contacts of cam E, through the (O) segment, making the trunk busy to

all other hunting selectors. When the switch enters position 8 1/2, permanent busy ground is connected to the (S) terminal of the selected trunk through the upper contacts of cam E and the (O) commutator segment.

10. SELECTION BEYOND

10.1 CLOSURE OF FUNDAMENTAL

With the switch in position 9, the (L) relay operates from ground in the sender circuit through the (SC) brush of the sender selector, lower outer and upper inner contacts of cam H to battery through the inner winding of the (L) relay. The L relay operated, advances the switch to position 10 from ground on cam H. With the switch in position 10, the fundamental circuit is established for selection beyond, by the closure of leads FT and FR through the upper inner contacts of cam F, and lower contacts of cam G, respectively, to the tip and ring of the selected trunk.

10.2 CORD DISCONNECTED FROM SENDER

When selection beyond has been completed, the circuit through the (L) relay is opened, releasing the relay. The (L) relay released, advances the switch to position 11. As the switch advances out of position 10 1/2, the sender circuit is disconnected from the intercepting and zero operator's cord circuit by opening the circuit through the lower outer contact of cam S and the upper outer contact of cam Q.

11. TALKING SELECTION

With the switch in position 11, the associated sender circuit connects ground through the (FT) brush of the sender selector, make contact of the CI relay, lower contacts of cam L to battery through the inner winding of the (L) relay. The (L) relay operated locks to the same ground and advances the switch out of position 11. The switch continues to advance until the (L) relay is released by the operation of the sender circuit. As the switch advances, ground is intermittently connected to the tip side of the fundamental circuit through the outer contacts of cam E, cam L and operated (CI) relay, holding the (L) relay operated through its inner winding but successively short-circuiting and permitting the re-operation of the

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stepping relay in the sender circuit. When sufficient pulses have been sent back to satisfy the sender, the fundamental circuit is opened, releasing the (L) relay. The release of the (L) relay opens the circuit through the (R) magnet stopping the switch in position 12, 13 or 14 depending on the talking selection required.

11.1 SENDER RELEASED

When the switch advances out of position 11, the (CI) relay locks from battery through the 200-B selector magnet, winding of the (CI) relay, inner contacts of cam N, make contact of the (CI) relay, lower inner and upper contacts of cam M, make contact of the (L) relay to ground through the lower inner and upper outer contacts of cam E. When the (L) relay releases in position 12, 13 or 14, the (CI) relay releases, disconnecting the sender circuit and advancing the switch to position 15.

11.2 CORD EXTENDED TO TRUNK

When the switch enters position 15, the cord circuit is closed through to the selected trunk. In positions 12 to 14, the 500 ohm 18-AC resistance is bridged across the fundamental circuit for the purpose hereinafter described under "Wipe Out".

12. DISCONNECTION

12.1 OPERATOR DISCONNECTS

The withdrawal of the plug of the intercepting and zero operator's calling cord from the jack of the district circuit releases the (SL) relay, but the (TRC) relay remains operated from battery, through its outer winding to ground on cam H. The busy lamp remains lighted under control of ground on cam O. The (SL) relay released, advances the switch to position 18 from ground on the break contact of the (SL) relay through the lower contacts of cam D to battery through the R magnet. As the switch breaks position 17 the (TRC) relay releases and the (DOWN) magnet is operated from ground through the upper contacts or cam D, restoring the selector to normal. When the selector reaches normal the switch is advanced to position 1 by ground on the (Y) commutator through cam B, extinguishing the busy lamps and restoring the circuit to normal.

12.2 REGISTERS

In position 17 1/2, ground is supplied through the outer contacts of cam E, upper inner contact of cam L and lower inner contact of cam K for operating a register in the selector group register circuit in order to register the number of times the district is used. A circuit is closed in positions 2/18 through the outer contacts of cam T for the purpose of recording on a register the number of times that all districts are busy at the same time.

13. OVERFLOW

13.1 ADVANCE OF SWITCH TO OVERFLOW POSITION.

If all the trunks in the selected group are busy, the selector while trunk hunting in position 8, will travel to the top of the group and rest on the overflow terminals. As there is no ground on the sleeve of the overflow terminal, the (L) relay releases advancing the switch to position 9. With the switch in position 9, ground on the (SC) lead of the sender circuit operates the (L) relay through its inner winding through the lower outer and upper inner contacts of cam K. The (L) relay operated, advances the switch to position 10. The Z commutator, when the selector is on the overflow terminals, advances the switch to position 11 through the upper contacts of cam K releasing the (L) relay. With the switch in position 11, the (L) relay operates from ground on the Z commutator brush and segment through the upper outer contact of cam K, lower inner contact of cam L to battery through its inner winding. The (L) relay operated, locks to ground on the Z commutator brush and segment. The (L) relay operated, advances the switch to position 16.

13.2 SIGNAL TO OPERATOR

In position 16 a circuit is closed from ground and make contact of the interrupter, cam P, through the winding of a relay in the cord circuit, inner contacts of cam Q, 18-AC resistance, to battery through cam S, causing the supervisory lamp in the cord circuit to flash as an overflow signal. The withdrawal of the plug of the cord circuit restores this circuit to normal as described under "DISCONNECTION".

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13.3 OVERFLOW REGISTER

When the switch enters position 16 1/2, a circuit is closed to operate the overflow register from ground on the Z commutator brush and segment, lower contacts of cam F, tip brush to battery through the overflow register in the associated overflow register circuit, not shown.

13.4 "C" COMMUTATOR

The function of the "C" commutator segment is to maintain an idle condition on the multiple overflow terminals, so that more than one selector may stop on overflow at one time; otherwise, the first selector reaching overflow would make the sleeve multiple terminals busy, thus causing succeeding selectors to continue upward into the next group of trunks. The "O" commutator segment is open at overflow, but the S bar is continuous. Both the "O" and "S" commutator brushes are permanently strapped together and wired to the multiple sleeve brush. When a selector is at overflow, the "O" commutator brush is resting on an open (dead) segment and, as the busy ground is fed through the "O" commutator bar only, this arrangement maintains a non-busy condition on the sleeve terminals. When necessary to combine two or more groups of trunks, the multiple sleeve overflow terminals between the combined groups are made permanently busy by being connected to ground. As the "S" commutator bar is closed at overflow, the (L) relay is held operated at this time, and the selector therefore hunts past the "made busy" terminals into the next group.

13.5 OVERFLOW DURING SELECTION BEYOND

When the switch is in position 10, and an overflow condition is encountered in the incoming circuit while making selection beyond reverse battery is sent back from the incoming circuit over the tip and ring of the fundamental circuit, through the inner contacts of cam F and the lower contacts of cam G, over leads FT and FR operating a relay in the sender circuit and thereby removing ground from the SC lead, releasing the (L) relay. The (L) relay released, advances the switch to position 11. With the switch in position 11, the sender circuit supplies ground over the FT

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lead, operating the (L) relay from battery through its inner winding, lower contacts of cam L make contact of the CI relay to ground over the FT lead. The (L) relay operated, locks to ground on the FT lead, advancing the switch to position 16. From this point on, the overflow signalling and disconnection operation are the same as previously described.

14. TELL TALE

When the district selector goes to tell tale during selection the switch is advanced to position 11 from ground on the X commutator brush and segment to battery through the R magnet. The switch will remain in position 11 unless the trouble is such that a ground is on the tip of the fundamental circuit, in which case, the (L) relay operates from ground on the FT lead advancing the switch to position 16, giving the overflow signal to the operator as described under "Overflow". The operator then withdraws the plug of the zero and intercepting cord circuit from the jack and makes a new call. In case the switch remains in position 11, failure to receive ringing induction would indicate to the subscriber and operator that there was a trouble condition.

15. WIPE OUT

15.1 BEFORE SELECTION BEYOND

In case the operator abandons the call by withdrawing the plug of the calling cord from the district jack before the switch advances out of position 6, the (SL) relay releases, advancing the switch to position 7, from ground on its break contact, through the lower contacts of cam D. With the switch in position 7, ground on the break contact of the (SL) relay operates the DOWN magnet through the lower outer and upper inner contacts of cam D, restoring the elevator to normal. In position 7, the (TRC) relay operates through its outer winding, to ground at cam H, removing battery through its inner winding from the tip of the circuit when the operator has withdrawn the plug from the jack. When the elevator reaches normal, the "Y" segment carries the switch to position 8. The R magnet energizes in position 8 from battery, winding cam B normal (L) relay, cam H to ground advancing the switch to position 9. In position 9 the R magnet energizes through the Y segment carrying the switch to position 1, extinguishing the busy lamps.

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15.2 AFTER SELECTION BEYOND

In case the operator abandons the call after the switch has left position 7, trunk hunting and selection beyond is made as in a regular call. When the switch advances to position 12, ground on the break contact of the (SL) relay through the lower contacts of cam D, advances the switch directly to position 18. The selector and switch are then restored to normal as described under "DISCONNECTION". As the switch passes position 12/14, the 500 ohm resistance is bridged across the fundamental circuit from lead (T) cams P, P and S, through the 500 ohm resistance, cams Q and G to lead (R) for the purpose of providing trunk closure to the incoming selector.

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December 3, 1924.